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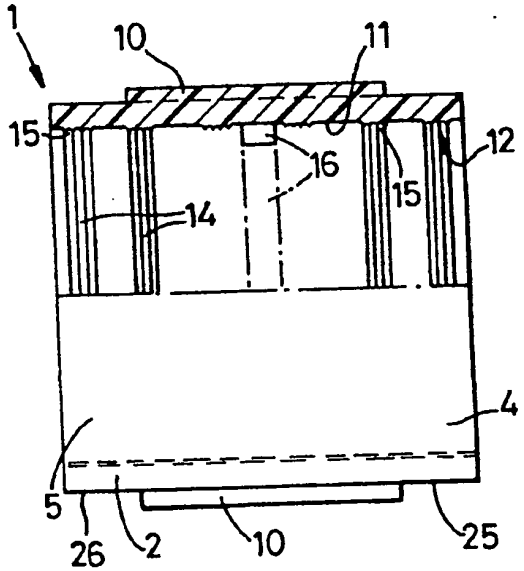
(54) Title: PLASTIC PIPE JOINTS

(57) Abstract

A coupling member (1) for use in forming a spin-welded joint between adjacent ends (6, 7) of plastics pipes (8, 9) comprises an elongate sleeve (2) having a longitudinal bore (3), opposite ends (4, 5) of the bore (3) constituting sockets each to receive an end (6, 7) of two adjacent pipe lengths (8, 9) to be joined, with formations (12, 13) on the surface (11) of the bore (3) projecting radially inwardly of the bore (3), so as to result in positive contact between the formations (12, 13) of each socket and the external periphery (17, 18) of the pushed-in pipe end (6, 7), at least the surface (11) of the bore (3), and also the formations (12, 13), being formed from an appropriate plastics material compatible with the plastics material of the pipes (8, 9) to be joined, whereby, upon spinning the coupling member (10, a spin-welded joint may be effected. The invention also includes portable apparatus (19) for producing a spin-welded pipe joint comprising clamp members (20, 21) and a drive belt (27) engageable with a coupling member (1).



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PLASTIC PIPE JOINTS

This invention relates to coupling members for use in producing plastic pipe joints by spin-welding; and apparatus for producing a spin-welded plastic pipe joint.

There is the growing employment of plastics pipes in the gas and water supply industries as well as the electricity and telecommunications industries, where the supply or service can be provided below ground level. The employment of plastics pipes for the supply of gas or water, or along which plastic pipes appropriate cables, wires, carbon fibres or the like can pass, has many advantages in combining long life, strength and flexibility, but plastics pipes are produced in finite lengths, with the attendant problem of jointing one pipe length to another, and usually with one pipe length, at least, already laid in a trench or other excavation. With the supply of gas, there is the essential need for a gas-tight joint between one pipe length and the next, and which has led to the development of portable equipment enabling the on-site butt welding of one pipe end to the next - typically whilst the pipes are being laid in a trench. Whilst not involving the same degree of danger to the public there is the need to prevent the leakage of water at a water supply pipe joint and, where pipes are used as trunking for electrical and/or telecommunications cables, the need to have a joint able to prevent ingress of water and debris.

In contrast to butt-welding, another known

technique is spin-welding whereby with contact engagement between the components to be joined, one component is rotated at high speed for a short period of time, with the resulting heat generated by the frictional contact between the components melting the plastics, so that, upon cooling, a welded joint results.

Spin-welding apparatus has, in the past, largely been restricted to factory use, with no apparatus for on-site use being available. Also previous equipment has generally required a free end of the pipe so that, after completing a spin-welded joint, the joint and the apparatus may be disengaged - by sliding the apparatus along the pipe until the free end is reached, or by sliding the pipe through the apparatus. Such disengagement is scarcely possible at on-site locations.

A first object of the present invention is to provide an improved coupling member for use in the production of a joint between adjacent ends of pipe lengths of plastics material. A second object of the invention is to provide a portable apparatus for producing a spin-welded plastic pipe joint.

According to a first aspect of the present invention, a coupling member for use in forming a spin-welded joint between adjacent ends of plastics pipes, comprises an elongate sleeve having a longitudinal bore, opposite ends of the bore constituting sockets each to receive an end of two adjacent pipe lengths to be joined, with formations on the surface of the bore projecting

radially inwardly of the bore, so as to result in positive contact between the formations of each socket and the external periphery of the pushed-in pipe end, at least the surface of the bore, and also the formations, being formed from an appropriate plastics material compatible with the plastics material of the pipes to be joined, whereby, upon spinning the coupling member, a spin-welded joint may be effected.

The coupling member is intended to fit over the adjacent ends of lengths of plastics pipe with the projecting formations being such as to ensure local contact between the formations and the surfaces of the pipe ends, irrespective as to any irregularity or deviation from true circularity at the ends of the plastics pipes. With the coupling member then spun at relatively high speed for a prescribed period of time the friction between the formations and the outer surfaces of the pipe ends generates sufficient heat to cause surface melting at the pipe ends and the formations, effective welding as between the coupling member and the pipe ends can be substantially guaranteed. Compared with the more conventional fit with large surface area contact, either with tapered or cylindrical abutting surfaces of the coupling member and pipe ends, the invention provides firstly minimal initial contact to minimise the start-up torque, thereby reducing the power required to commence spinning of the coupling member, and secondly an initial keying effect between the coupling member and the pipe ends. A further benefit of

the invention is that by providing formations within the bore of the coupling member space is provided within the length of the coupling member to accommodate expansion of the plastics material, particularly of the surfaces of the pipe ends, with a consequent minimising and possibly prevention of molten plastics material exuding beyond the ends of the coupling member which would otherwise decrease the amount of molten plastics material available for the production of a weld and additionally create an unsightly appearance at the ends of the coupling member.

The projecting formations on the bore of the coupling member may extend circumferentially or axially, or both circumferential and axial formations may be provided. The formations may simply be constituted by the provision of a number of longitudinally and/or axially spaced ribs, but other formations, such as, nibs, beads, saw-teeth, may be provided.

The coupling member may be formed wholly from an appropriate plastics material or may be formed as an outer sleeve-like member of one (e.g. plastics) material with an inner lining of a plastics material compatible with the material of the pipe ends to be joined.

To facilitate the rotation of the coupling member, particularly non-slip rotation, it is preferred to form its outer periphery with spaced longitudinal ribs or with gear teeth, for engagement with an appropriate drive mechanism.

According to a second aspect of the present invention, of independent significance, there is provided

portable apparatus for producing a spin-welded pipe joint, comprising:

(i) a pair of co-operable clamp members which are (a) openable to a position for firstly receiving a coupling member defining sockets into which are pushed ends of two adjacent pipe lengths to be joined by spin welding, and subsequently for removal of the completed pipe joint and (b) closable to an operational position in which spin-welding is effected;

(ii) transversely spaced apart abutment means provided on at least one of the clamp members, for the location and axial constraint therebetween of a coupling member;

(iii) co-operating recesses in the clamp members for passage therethrough, and the securing from rotation, of the ends of lengths of plastics pipe;

(iv) releasable locking means to lock the clamp members together in their operational position; and

(v) a drive mechanism operationally connectable to the coupling member to spin the latter to produce a spin-welded pipe joint.

Thus, with the clamp members opened, a coupling member, into opposite ends of which have been inserted the ends of two lengths of plastics pipe to be joined, can be positioned on a first clamp member with the pipe ends lying in the e.g. semi-circular, recesses in that clamp member and with the coupling member located between abutment means on that clamp member. With the second clamp member then

displaced to the closed position and locked in place, the respective pipe ends are held securely and the coupling member left free to be rotated by the drive mechanism.

The clamp members may be completely separable from one another or may be hinged together. Manually operable locking means, e.g. comprising screws, cams, levers, or a combination of such, may be provided to lock the two clamp members together in the closed, operational position. Preferably, the drive mechanism is located within a housing associated with one clamp member, whilst a pair of spaced apart location rollers may be provided on the other clamp member.

In detail, the drive mechanism may comprise a toothed belt extending around pulleys positioned within the housing and such that when the clamp members are secured together the coupling member is held firmly against the toothed belt with engagement between the toothed belt and the gear tooth formations on the coupling member. Thus, one of the pulleys may be rotated via appropriate drive means, to drive the belt and hence rotate the coupling member. Preferably, a gear train means is provided in the housing and associated with one of the pulleys, the endmost gear wheel of the gear train having a drive shaft extending out of the housing and for engagement with, for example, a relatively conventional electric hand drill.

The optional provision of spaced location rollers on one clamping member provides, in conjunction with the loading of the coupling member against the toothed belt, a

triangulation of the forces applied to the coupling member with then the guarantee that the coupling member and the ends of the pipes remain co-axial and axially stationary during the rotation of the coupling member, to assist considerably in the creation of an effective weld. To facilitate engagement between the coupling member and the location rollers, a part of the length of the coupling member may be left free from ribs or gear tooth formations to provide a plain sector at the periphery of the coupling member to be engaged by plain location rollers.

The invention will now be further described, by way of examples, with reference to the accompanying drawings in which;

Figure 1 is a part sectional side elevation of a first embodiment of coupling members in accordance with the invention;

Figure 2 is an end elevation of Figure 1;

Figure 3 corresponds to Figure 1 but shows a second embodiment;

Figure 4 is an end elevation of Figure 3;

Figure 5 is a side elevation of apparatus for effecting spin welding of the coupling members of Figures 1 to 4; and

Figure 6 is an end elevation of Figure 5.

In the drawings, a plastics coupling member 1 comprises an elongate sleeve 2 having a longitudinal bore 3, opposite ends 4, 5 of which constitute sockets, each to receive, as a manual, push-in fit, opposite ends 6, 7 of

two adjacent, plastics pipe lengths 8, 9 to be coupled. The coupling member 1 is provided on its outer periphery, with spaced longitudinal ribs or gear teeth 10 by which the coupling member 1 is spun, as will be described later.

In accordance with the first aspect of the invention, the surface 11 of the bore 3 is provided with circumferential projections 12 in the embodiment of Figures 1 and 2, and longitudinal projections 13 in the embodiment of Figures 3 and 4.

In the embodiment of Figures 1 and 2, the projections 12 are provided by six axially spaced-apart groups 14 of four saw teeth 15. If a stop ring 16 is provided within the bore, against opposite sides of which the pipe ends 6, 7 may be abutted to ensure adequate penetration, three groups 14 of teeth 15 may be provided to each side of the stop ring.

In the embodiment of Figures 3 and 4, the longitudinal projections 13 are again in the form of saw teeth 15 e.g. at 2° angular spacing. The teeth 15 may extend over 360° or may be in groups e.g. 90°, 45°, 30° etc. apart.

The extent of penetration of the projections 12 and 13 from the normal diameter of the bore 3 is such that even with pipe ends 6 and 7 having poor tolerances, firstly the pipe ends 6 and 7 may be manually pushed into a coupling member 1 with relative ease, and secondly that local contact can be guaranteed between at least some of the projections 12, 13 and the external peripheries 17, 18 of

the pipe ends 6, 7.

Apparatus 19 for spinning the coupling member 3 to form the pipe coupling is shown in its closed, operational position in Figures 5 and 6 and comprises a pair of co-operable clamp members being an upper clamp member 20 and a lower clamp member 21 which, in the closed position, engages one another at an interface 22.

The lower clamp member 21 is adapted to seat on the ground 23 - typically the floor of a trench, and is provided with two spaced-apart location rollers 24 to engage external shoulders 25, 26 of the coupling member 3 to support the coupling member 3 and maintain the coupling member 3 and pipe ends 6, 7 co-axial, when drive is applied to the coupling member 3 to effect spin welding by a toothed belt 27 within a housing 28 of the upper clamp member 20 engaging the teeth 10 of the coupling member, as will be described in detail later.

Each clamp member 20, 21 is provided with transversely abutment means 29, 30 spaced apart by a distance comfortably exceeding the axial length of the coupling member 3. Also, each clamp member 20, 21 has a semi-circular recess 31, 32. Also within the housing 28 are toothed pulleys 33, 41 around which the belt 27 is wrapped. The pulley 41 is attached to a shaft 42 to which is also attached a pulley 43. Around the latter and an input pulley 44 is wrapped a second toothed drive belt 45 having an input spindle 46 with a peg 47 releasably attachable to a hand-held electric power tool. The two

clamp members 20, 21 are secured together by manually operable nuts and bolts 35 having an axis 36, passing through flanges 37, 38 of the clamp members 20, 21 respectively. Bolts 35 on axes 36 suffice when a hinge 39 between the clamp members 20 and 21 is provided. If the clamp members 20, 21 are completely separable, then further bolts secured on axes 40 are necessary.

Firstly however, the apparatus 19 must be opened to allow insertion of the coupling member 3 and pipe ends 6, 7. This is acheived by unscrewing the nuts and bolts 35, so that the upper clamp member 20 can be either hinged open or totally removed from the lower clamp member 21 by separation at the interface 22. After insertion reverse procedure renders the apparatus 19 ready to effect spin welding. A suitable electrically powered hand tool (not shown) is connected to peg 47 to rotate the coupling member 3 via the transmission described above e.g. at 300 r.p.m. for e.g. 10 seconds.

The apparatus 19 is then re-opened, to allow its removal from the thus formed plastic pipe joint for use of the apparatus 19 at the next joint to be formed.

CLAIMS

1. A coupling member for use in forming a spin-welded joint between adjacent ends of plastics pipes comprises an elongate sleeve having a longitudinal bore, opposite ends of the bore constituting sockets each to receive an end of two adjacent pipe lengths to be joined, with formations on the surface of the bore projecting radially inwardly of the bore, so as to result in positive contact between the formations of each socket and the external periphery of the pushed-in pipe end, at least the surface of the bore, and also the formations, being formed from an appropriate plastics material compatible with the plastics material of the pipes to be joined, whereby, upon spinning the coupling member, a spin-welded joint may be effected.

2. A coupling member as claimed in Claim 1 wherein the projecting formations on the bore of the coupling member extend circumferentially.

3. A coupling member as claimed in Claim 1 wherein the projecting formations on the bore of the coupling member extend axially.

4. A coupling member as claimed in Claim 1 wherein the projecting formations on the bore of the coupling member extend both circumferentially and axially.

5. A coupling member as claimed in any preceding claim, wherein the formations are constituted by the provision of a number of longitudinally and/or axially spaced ribs, nibs, beads or saw-teeth.

6. A coupling member as claimed in any preceding claim formed wholly from an appropriate plastics material.

7. A coupling member as claimed in any one of Claims 1 to 5, formed as an outer sleeve-like member of one (e.g. plastics) material with an inner lining of a plastics material compatible with the material of the pipe ends to be joined.

8. A coupling member as claimed in any preceding claim, having its outer periphery formed with spaced longitudinal ribs or with gear teeth, for engagement with an appropriate drive mechanism.

9. Portable apparatus for producing a spin-welded pipe joint, comprising:

(i) a pair of co-operable clamp members which are (a) openable to a position for firstly receiving a coupling member defining sockets into which are pushed ends of two adjacent pipe lengths to be joined by spin welding, and subsequently for removal of the completed pipe joint and (b) closable to an operational position in which spin-welding is effected;

(ii) transversely spaced apart abutment means provided on at least one of the clamp members, for the location and axial constraint therebetween of a coupling member;

(iii) co-operating recesses in the clamp members for passage therethrough, and the securing from rotation, of the ends of lengths of plastics pipe;

(iv) releasable locking means to lock the clamp

members together in their operational position; and

(v) a drive mechanism operationally connectable to the coupling member to spin the latter to produce a spin-welded pipe joint.

10. Apparatus as claimed in Claim 9, wherein the clamp members are completely separable from one another.

11. Apparatus as claimed in Claim 9, wherein the clamp members are hinged together for opening and closing.

12. Apparatus as claimed in any one of Claim 9 to 11, comprising manually operable locking means to lock the two clamp members together in the closed, operational position.

13. Apparatus as claimed in any one of Claims 9 to 12, wherein the drive mechanism is located within a housing associated with one clamp member.

14. Apparatus as claimed in Claim 13, wherein a pair of spaced apart location rollers are provided on the other clamp member.

15. Apparatus as claimed in any one of Claims 9 to 14, wherein the drive mechanism comprises a toothed belt extending around pulleys positioned within the housing and such that when the clamp members are secured together the coupling member is held firmly against the toothed belt with engagement between the toothed belt and the gear tooth formations on the coupling member.

16. Apparatus as claimed in Claim 15, wherein one of the pulleys is rotatable via a powered drive means.

17. Apparatus as claimed in Claim 16, wherein the

power d drive means is an electrically powered, hand held tool.

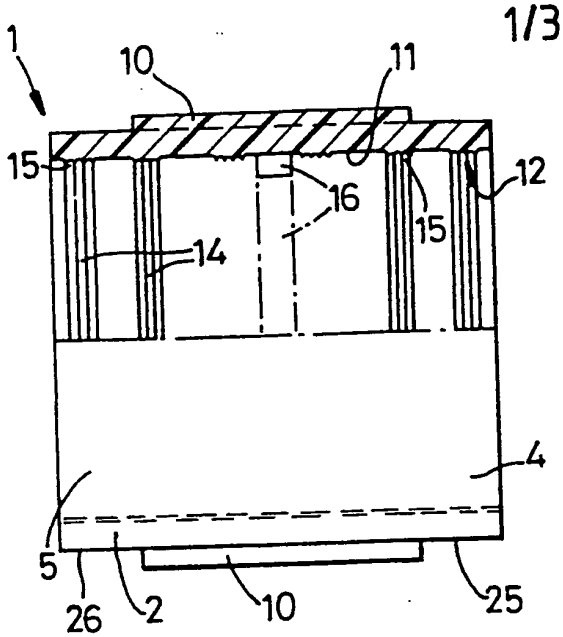

Fig. 1

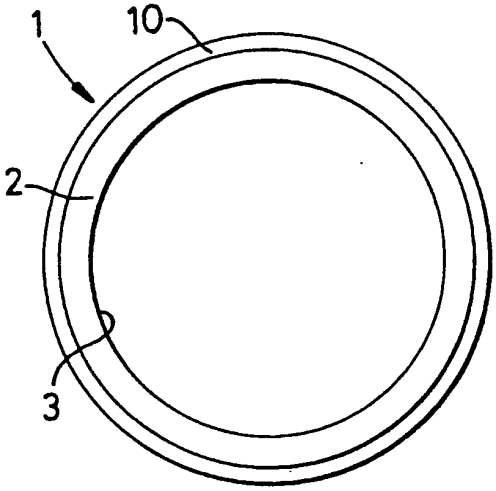

Fig. 2

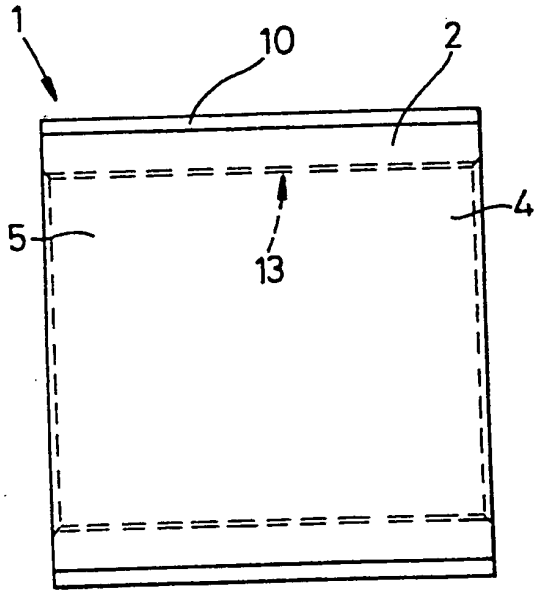

Fig. 3

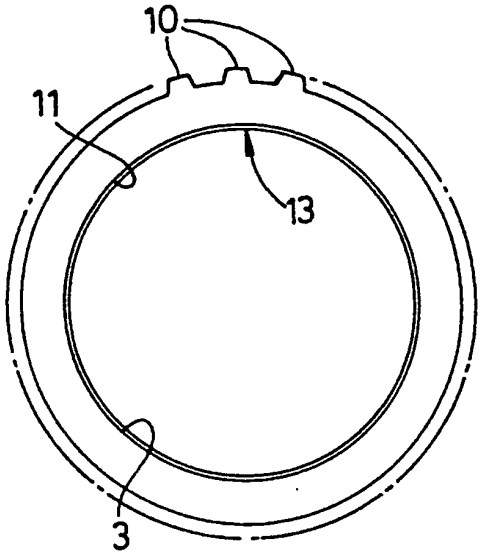

Fig. 4

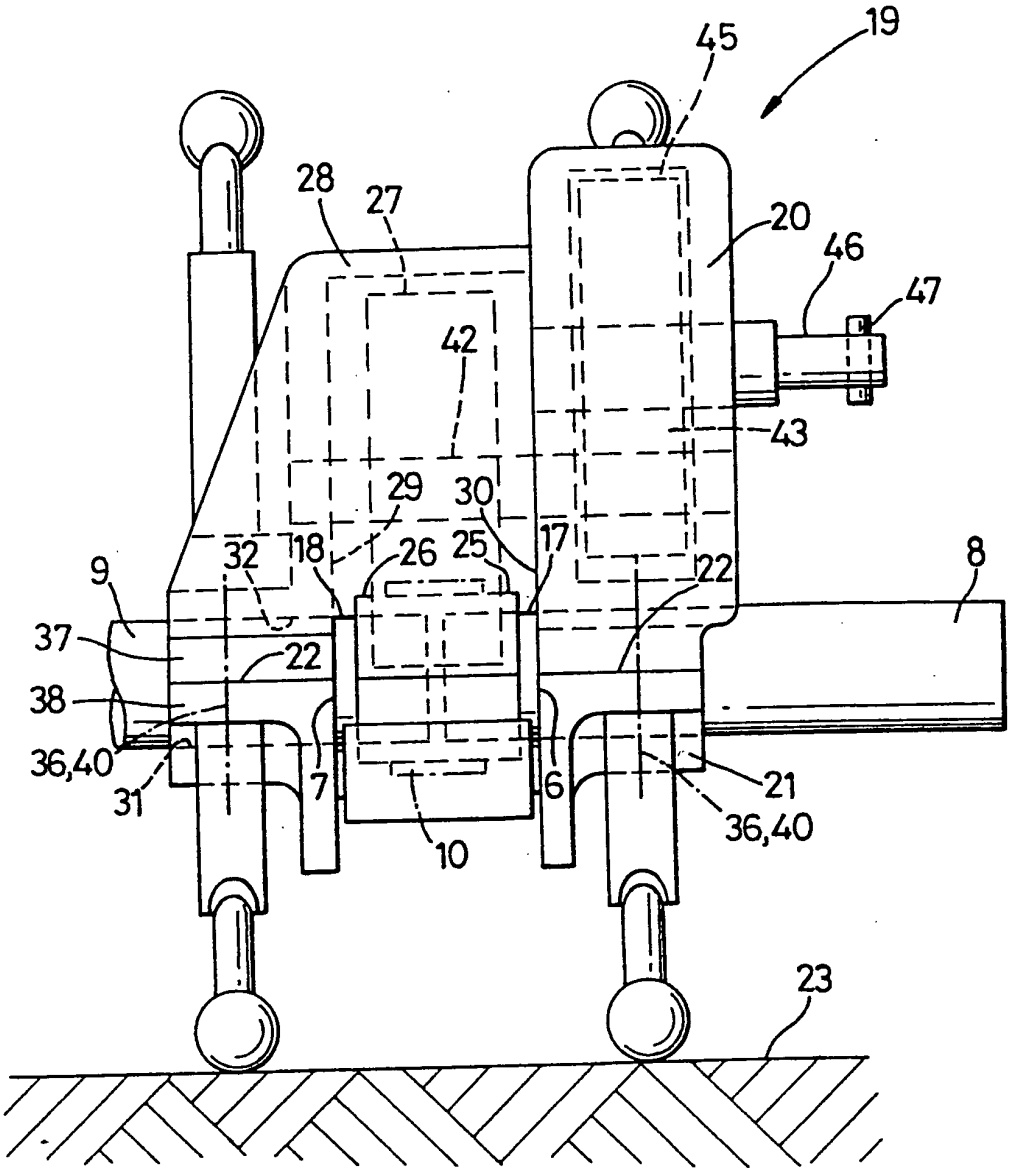
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Fig. 5

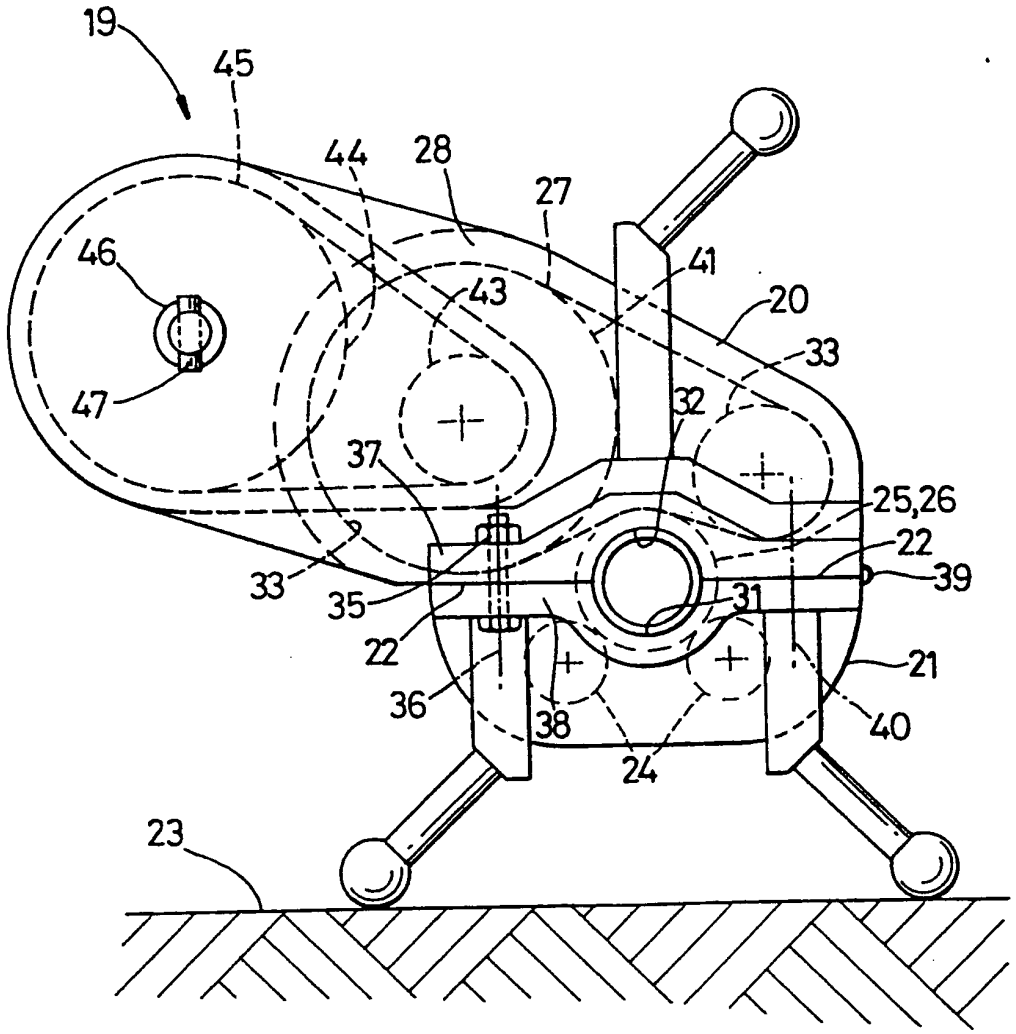
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Fig. 6

INTERNATIONAL SEARCH REPORT

Inter. ional Application No
PCT/GB 94/00791

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 F16L47/02 B29C65/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 F16L B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO,A,92 17328 (FUSION GROUP PLC.) 15 October 1992 see claims 1,2; figures ---	1-17
A	US,A,3 351 512 (O. VON ZELEWSKY ET AL.) 7 November 1967 see figures -----	9-17

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
21 July 1994	02.08.94

Name and mailing address of the ISA	Authorized officer
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Information on patent family members

Inter. nal Application No
PCT/GB 94/00791

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-9217328	15-10-92	AU-A-	1422892	02-11-92
		EP-A-	0577651	12-01-94
US-A-3351512		NONE		